Hazard Elimination Project Evaluation

Project Log # 200608066

Hazard Elimination Project W-4000

Evaluation of the Intersection Realignment, Construction of Left Turn Lanes, and the Installation of a Traffic Signal at the Intersection of NC 226 (Earl Rd), SR 1100 (Sulpher Springs Rd), and SR 1213 (County Home Rd) Cleveland County

Documents Prepared By:

Safety Evaluation Group
Traffic Safety Systems Management Section
Traffic Engineering and Safety Systems Branch
North Carolina Department of Transportation

Principal Investigator

_____ 3/31/2008
Brad Robinson Date

Traffic Safety Project Engineer

Hazard Elimination Project Evaluation Documentation

Subject Location

Evaluation of Hazard Elimination Project W-4000 – NC 226 (Earl Rd) at SR 1100 (Sulpher Springs Rd) and SR 1213 (County Home Rd) in Cleveland County.

Project Information and Background from the Project File Folder

There were three safety countermeasures chosen for the subject location:

- The realignment of SR 1100 (Sulpher Springs Rd) so that it intersects NC 226 (Earl Rd) across from SR 1213 (County Home Rd). In the before period SR 1100 intersected NC 226 approximately 100 feet west of SR 1213.
- The construction of left turn lanes for both approaches of NC 226. In the before period NC 226 had single lane approaches to the intersection.
- The installation of a signal at the newly constructed intersection. In the before period the intersections were stop sign controlled on SR 1100 and SR 1213.

SR 1100 and SR 1213 are both two-lane roadways with no posted speed limits. NC 226 has a speed limit of 45 mph.

According to the provided project background, SR 1100 did not have adequate sight distance to the stop sign, which contributed to a Ran Off Road crash pattern as vehicles ran through the stop sign and down an embankment. Additionally, the approximately 100 foot offset of the two intersections was causing a safety hazard for motorists wanting to cross NC 226 and continue to travel on the secondary roads. Before the project motorists were first required to make a right turn onto NC 226 and then immediately turn left onto the secondary road.

The initial crash analysis was completed from November 1, 1992 to October 31, 1997 with 22 reported crashes. Six of these crashes were Ran Off Road Crashes and ten were Angle Crashes. The benefit to cost ratio was calculated to be 39.25. The final completion date for the improvement at the subject intersection was on July 3, 2001 with a total cost of $400,000.

Naive Before and After Analysis

After reviewing the hazard elimination project file folder along with all the crashes at the subject location, the crash data omitted from this analysis to consider for an adequate construction period was from May 1, 2001 through August 31, 2001. The before period consisted of reported crashes from June 1, 1995 through April 30, 2001 (5 years, 11 months) and the after period consisted of reported crashes from September 1, 2001 through July 31, 2007 (5 years, 11 months). The ending

date for this analysis was determined by the available crash data at the time the crash analysis was completed.

The treatment data consisted of all reported crashes within 150 feet of the subject intersections.

The following data tables depict the Naive Before and After Analysis for the treatment location. Because there were three different countermeasures chosen for the subject location, no specific Target Crashes were chosen for the project. The *Results and Discussion* section looks closer at the changes in crash patterns from the before to the after period.

Treatment Information	**Before**	**After**	**Percent Reduction (-) Percent Increase (+)**
Total Crashes	26	16	-38.5
Total Severity Index	12.88	9.44	-26.7
Volume	8,200	9,100	11.0

Injury Summary	**Before**	**After**	**Percent Reduction (-) Percent Increase (+)**
Total Injury Crashes	14	9	-35.7
Fatal Crashes	1	1	0.0
Class A Crashes	2	0	-100.0
Class B Crashes	2	0	-100.0
Class C Crashes	9	8	-11.1
Property Damage Only (PDO) Crashes	12	7	-41.7

The naive before and after analysis at the subject intersection resulted in a 39 percent decrease in Total Crashes, a 27 percent decrease in the Severity Index, and an 11 percent increase in Average Daily Traffic (ADT). The before period ADT year was 1998 and the after period ADT year was 2004.

Results and Discussion

The naive before and after analysis involving the comparison of treatment actual before data versus treatment actual after data resulted in a 39 percent decrease in Total Crashes and a 27 percent decrease in the Total Severity Index. The summary results above demonstrate that the treatment location appears to have had a decrease in both the number and severity of Total Crashes from the before to the after period.

The calculated benefit to cost ratio for this project is 3.96 considering total crashes. The benefits are calculated using the change in annual crash costs from the before to the after period. Operational and other benefits related to the project are not considered in this analysis. The costs of the project include the actual construction costs as well as the increase in annual maintenance costs.

In the before period there were five crashes that involved vehicle attempting to travel from one of the secondary roads to the other (Before Crashes # 4, 5, 6, 12, and 25). These crashes resulted in one Fatal Crash, one "A" Injury Crash, and two "C" Injury Crashes. As stated in the above *Project Background* section, motorists had to make a right and then a left to make this movement in the before period. The realignment of SR 1100 eliminated the need for this type of movement.

There were three Ran Off Road Crashes in the before period involving vehicles running the stop sign on SR 1100. The realignment of SR 1100 also eliminated this type of crash. It is not clear how well the realignment and signal installation improved the inadequate site distance that was stated as a problem in the project folder as a site visit was not conducted by the analyzer in the before period. There is now a curve on SR 1100 just prior to the intersection, although there appears to be adequate site distance to the signal. There were two Angle Crashes in the after period in which a vehicle ran the stop signal for SR 1100 (one resulting in a Fatal Crash) and one Angle Crash in which fault was unclear.

In the before period there were five Rear-End Crashes on NC 226 involving vehicles approaching one of the intersections. In the after period there was only one Rear-End Crash on NC 226. The construction of the left turn lanes probably contributed to the decrease in this crash pattern.

As the Safety Evaluation Group completes additional reviews for this type of countermeasure, we will be able to provide more objective and definite information regarding actual crash reduction factors.

BENEFIT-COST ANALYSIS WORKSHEET

LOCATION: NC 226 at SR 1100 and SR 1213 BY: Brad Robinson
COUNTY: Cleveland DATE: 3/25/2008
FILE NO.: W-4000

DETAILED COST: TYPE IMPROVEMENT - Realignment, Left Turn Lanes, Signal

ITEMS	TOTAL	SERVICE	CRF	ANNUAL COST
Construction	$370,000	15	0.117	$43,227
	$0	0	0.000	$0
Right-of-Way	$30,000	50	0.082	$2,452
TOTALS	$400,000	16	0.114	$45,679

ESTIMATED INCREASE IN ANNUAL MAINT. COST = $2,000
ESTIMATED INCREASE IN ANNUAL UTILITY COST = $900

TOTAL ANNUAL COST= $48,579
TOTAL COST OF PROJECT= $400,000

COMPREHENSIVE COST REDUCTION:

ESTIMATED NUMBER OF ANNUAL ACCIDENT DECREASES

TIME PERIOD	YEARS	K & A CRASHES	K & A CRASHES PER YR	B & C CRASHES	B & C CRASHES PER YR	PDO CRASHES	PDO CRASHES PER YR	ANNUAL COSTS
BEFORE	5.92	3	0.51	11	1.86	12	2.03	$312,196
AFTER	5.92	1	0.17	8	1.35	7	1.18	$120,051

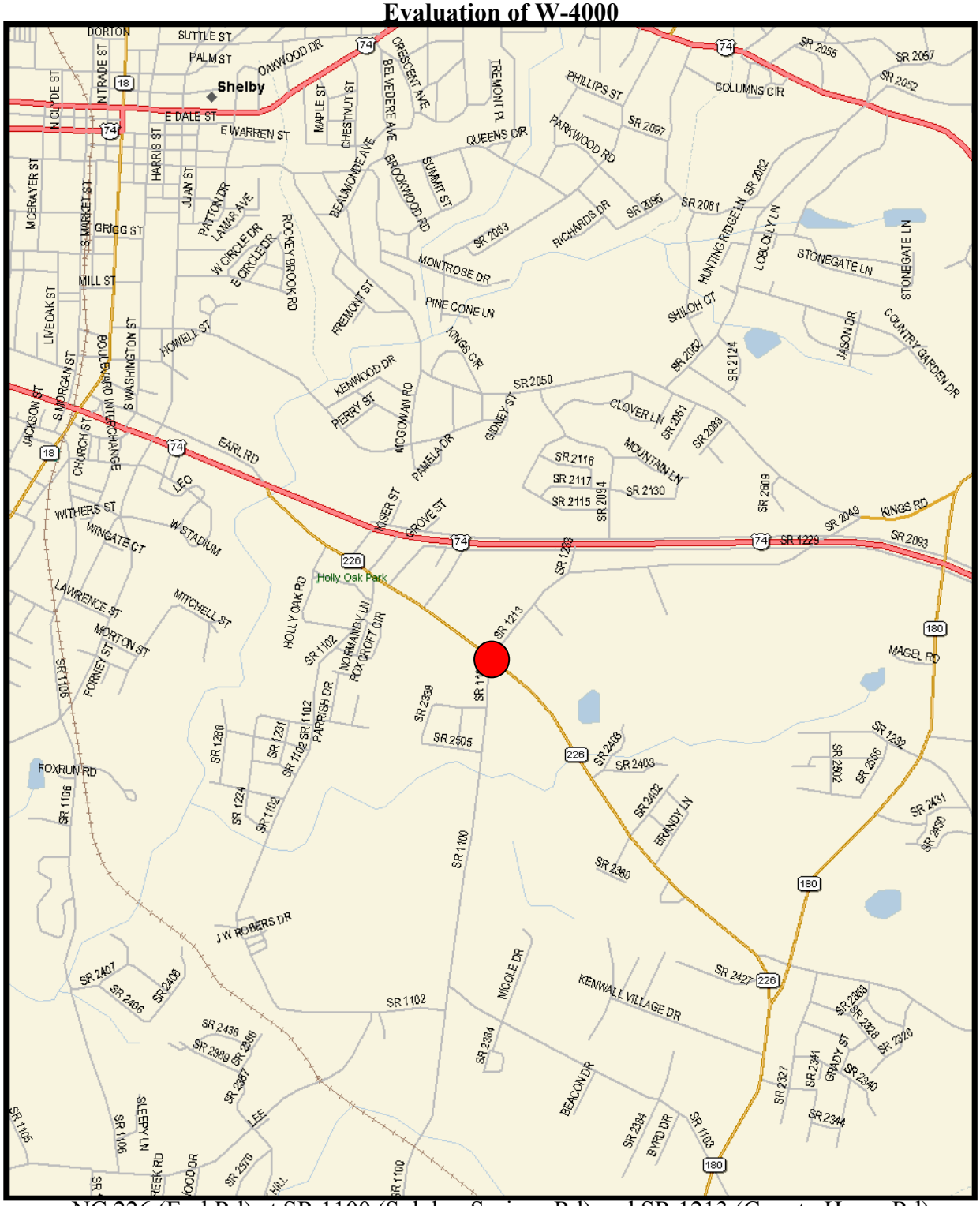
Annual Benefits from Crash Cost Savings $192,145

NET AVG. ANNUAL BENEFITS = AVG. ANNUAL BENEFITS - TOTAL ANNUAL COST = $143,566

BENEFIT-COST RATIO = AVG ANNUAL BENEFITS/TOTAL ANNUAL COST = 3.96

TOTAL COST OF PROJECT - $400,000 COMPREHENSIVE B/C RATIO - 3.96

Location Map
Cleveland County
Evaluation of W-4000



NC 226 (Earl Rd) at SR 1100 (Sulpher Springs Rd) and SR 1213 (County Home Rd)

Treatment Site Photos Taken March 17, 2008

Traveling East on NC 226 (Earl Rd)

Traveling East on NC 226 (Earl Rd)

Traveling West on NC 226 (Earl Rd)

Traveling West on NC 226 (Earl Rd)

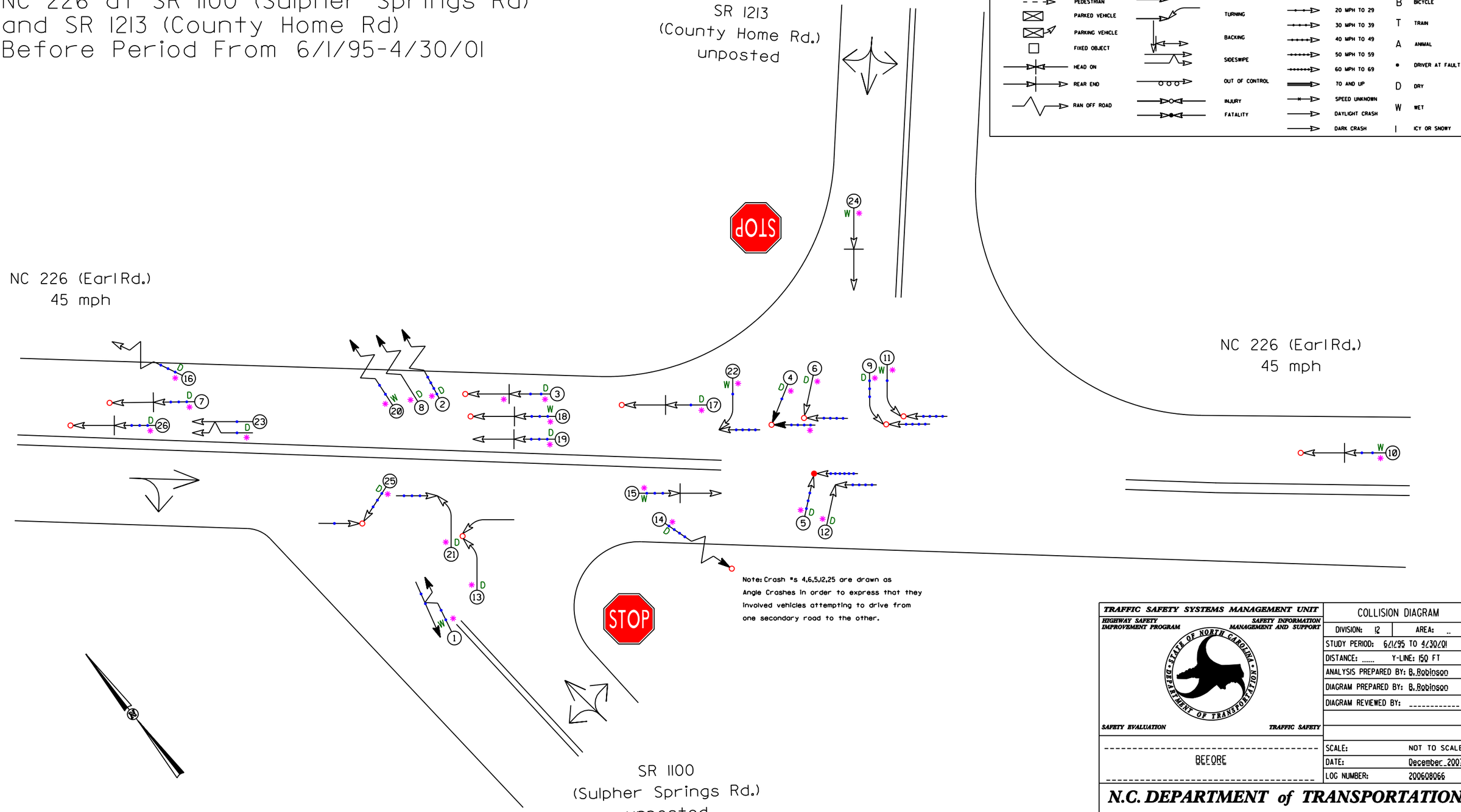
Traveling North on SR 1100 (Sulpher Springs Rd)

Traveling North on SR 1100 (Sulpher Springs Rd)

Traveling South on SR 1213 (County Home Rd)

Traveling South on SR 1213 (County Home Rd)

Cleveland County
NC 226 at SR 1100 (Sulpher Springs Rd) and SR 1213 (County Home Rd) Before Period From 6/1/95-4/30/01



TRAFFIC SAFETY SYSTEMS MANAGEMENT UNIT

HIGHWAY SAFETY IMPROVEMENT PROGRAM — SAFETY INFORMATION MANAGEMENT AND SUPPORT

SAFETY EVALUATION — TRAFFIC SAFETY

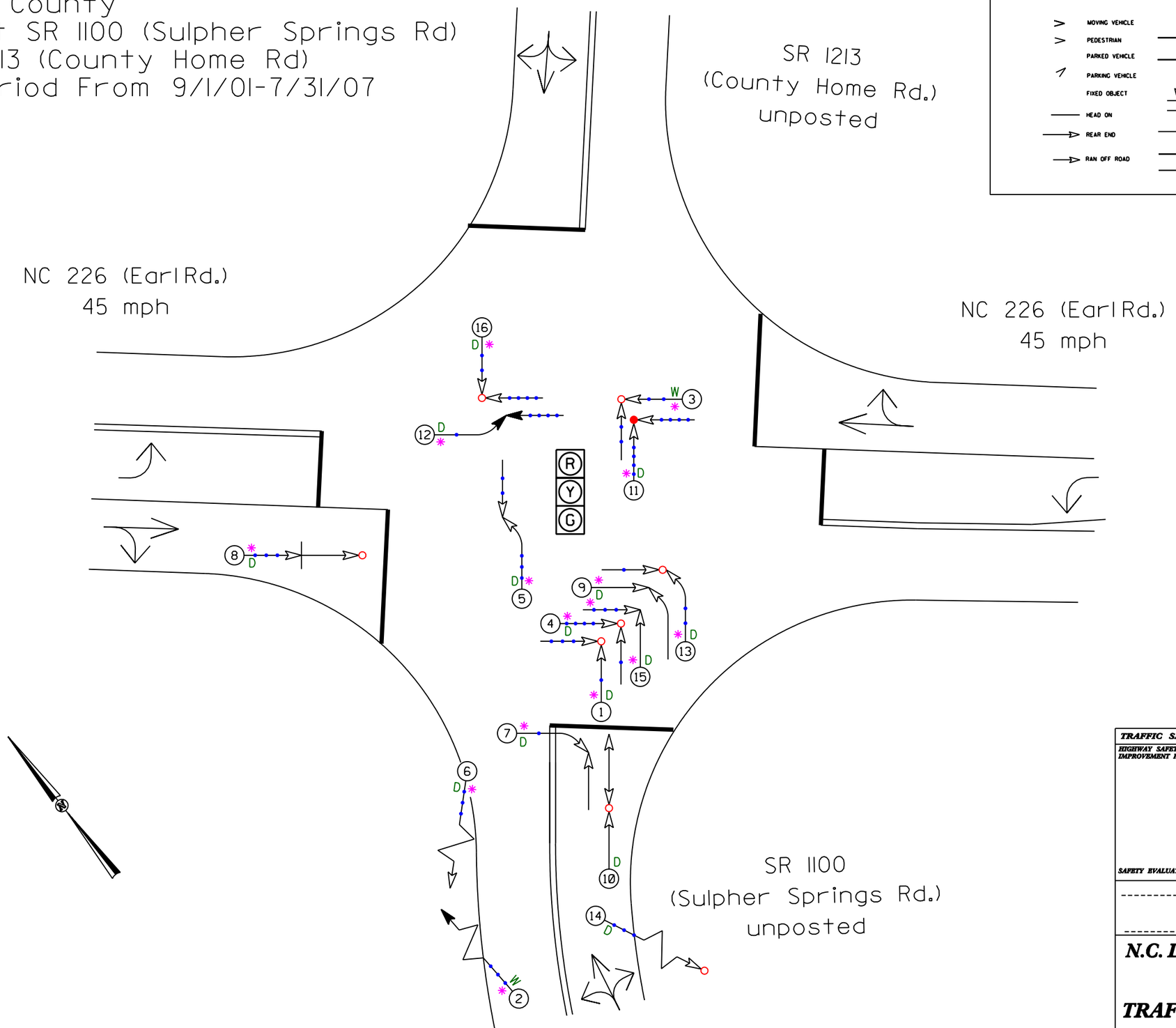
BEFORE

COLLISION DIAGRAM

DIVISION: 12	AREA: ..
STUDY PERIOD:	6/1/95 TO 4/30/01
DISTANCE:	Y-LINE: 150 FT
ANALYSIS PREPARED BY:	B. Robinson
DIAGRAM PREPARED BY:	B. Robinson
DIAGRAM REVIEWED BY:	----------
SCALE:	NOT TO SCALE
DATE:	December 2007
LOG NUMBER:	200608066

N.C. DEPARTMENT of TRANSPORTATION
DIVISION of HIGHWAYS
TRAFFIC ENGINEERING AND SAFETY SYSTEMS BRANCH

Cleveland County
NC 226 at SR 1100 (Sulpher Springs Rd) and SR 1213 (County Home Rd)
After Period From 9/1/01-7/31/07



LEGEND

MOVING VEHICLE	ANGLE	9 MPH OR LESS	P	PEDESTRIAN
PEDESTRIAN		10 MPH TO 19	B	BICYCLE
PARKED VEHICLE	TURNING	20 MPH TO 29		
PARKING VEHICLE	BACKING	30 MPH TO 39	T	TRAIN
FIXED OBJECT		40 MPH TO 49	A	ANIMAL
HEAD ON	SIDESWIPE	50 MPH TO 59		
REAR END	OUT OF CONTROL	60 MPH TO 69	•	DRIVER AT FAULT
RAN OFF ROAD	INJURY	70 AND UP	D	DRY
	FATALITY	SPEED UNKNOWN	W	WET
		DAYLIGHT CRASH		
		DARK CRASH	I	ICY OR SNOWY

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SAFETY EVALUATION — TRAFFIC SAFETY

AFTER

COLLISION DIAGRAM

DIVISION: 12	AREA: ..
STUDY PERIOD: 9/1/01 TO 7/31/07	
DISTANCE:	Y-LINE: 150 FT
ANALYSIS PREPARED BY: B.Robinson	
DIAGRAM PREPARED BY: B.Robinson	
DIAGRAM REVIEWED BY: _____	
SCALE:	NOT TO SCALE
DATE:	December 2007
LOG NUMBER:	200608066

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TRAFFIC ENGINEERING AND SAFETY SYSTEMS BRANCH